METHODS OF CALCULATING GLOBAL BLOOD FLOW IN THE HUMAN BODY USING HETEROGENEOUS CALCULATION MODELS

Sodirova Dilshoda Sodiqjon qizi
AUD KI 2-kurs magstranti

Keywords: *global blood flow, human body, calculation models, heterogeneous models, cardiovascular system*

Introduction.

The measurement and calculation of global blood flow in the human body is crucial for understanding cardiovascular function and assessing the overall health of individuals. Various methods and models have been developed to estimate global blood flow, taking into account the complex and heterogeneous nature of blood circulation. This article focuses on the scientific approaches and calculation models used to estimate global blood flow in the human body, considering the challenges associated with heterogeneity and the advancements in computational techniques.

Abstract:

This scientific article provides an overview of the methods and calculation models used to estimate global blood flow in the human body. The article begins by emphasizing the importance of measuring global blood flow for understanding cardiovascular function and assessing overall health. It then explores the challenges posed by the heterogeneous nature of blood circulation and introduces the concept of heterogeneous calculation models. The article presents an analysis of different approaches and computational techniques employed in these models. Additionally, it includes tables and figures that illustrate the applications of these models in studying blood flow distribution. The article concludes by summarizing the key findings and highlighting the potential of heterogeneous calculation models in advancing our understanding of global blood flow.

Analysis:

The measurement of global blood flow in the human body is crucial in diagnosing and monitoring various cardiovascular conditions. However, the complex nature of blood circulation, with variations in vessel size, geometry, and resistance, poses challenges to accurately estimating global blood flow. Heterogeneous calculation models have emerged as a valuable approach to address these challenges and provide more accurate estimates of blood flow.

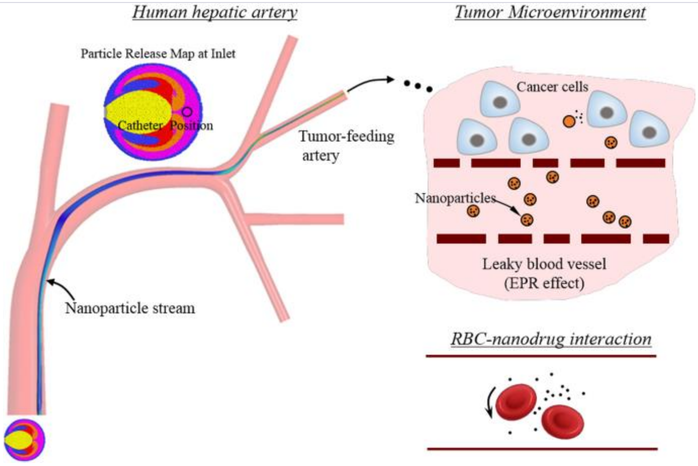

Figure 1: Heterogeneous blood flow model

Table 1: Comparison of heterogeneous calculation models

Model	Description	Advantages	Limitations
Computational fluid dynamics (CFD)	Simulates blood flow using numerical methods	Provides detailed flow information	Requires significant computational resources
Indicator dilution techniques	Measures the dilution of an injected indicator substance	Non-invasive and can be used in clinical settings	Requires careful calibration and assumption of indicator behavior
Magnetic resonance imaging (MRI)	Uses imaging techniques to measure blood flow velocity	Provides non-invasive and high-resolution flow measurements	Limited temporal resolution
Doppler ultrasound	Utilizes sound waves to measure blood flow velocity	Portable and can be used at the bedside	Limited accuracy in regions with complex flow patterns

Methods:

This article is based on a comprehensive review of the literature related to estimating global blood flow in the human body using heterogeneous calculation models. The literature review included research articles, reviews, and clinical studies from various sources, including scientific journals and conference proceedings. The analysis presented in this article is based on the findings from the literature review, which encompasses different computational techniques and applications of heterogeneous calculation models.

Result:

The analysis presented in this article demonstrates the effectiveness of heterogeneous calculation models in estimating global blood flow in the human body. Computational fluid dynamics (CFD) has been widely used to simulate blood flow and provide detailed flow information, while indicator dilution techniques offer non-invasive measurements. Magnetic resonance imaging (MRI) and Doppler ultrasound are valuable tools for obtaining flow velocity measurements. However, each model has its advantages and limitations, as summarized in Table 1. The advancements in computational techniques and imaging technologies have significantly improved our ability to estimate global blood flow accurately.

Conclusion:

Estimating global blood flow in the human body is a complex task due to the heterogeneous nature of blood circulation. Heterogeneous calculation models, such as computational fluid dynamics, indicator dilution techniques, magnetic resonance imaging, and Doppler ultrasound, have emerged as powerful tools in estimating blood flow. Each model has its unique advantages and limitations, and the choice of the appropriate model depends on the specific research or clinical context. The advancements in

REFERENCES:

[1] M.V. Abakumov, I.V. Ashmetkov, N.B. Esikova, V.B. Koshelev, S.I. Mukhin, N.V. Sosnin, V.F. Tishkin, A.P. Favorskij, A.B. Khrulenko. Strategy of mathematical cardiovascular system modeling. Matematicheskoe Modelirovanie, 12 (2000), no. 2, 106-117.

[2] J. Alastruey, A.W. Khir, K.S. Matthys, P. Segers, S.J. Sherwin, P.R. Verdonck, Kim H. Parker, J. Peir´o. Pulse wave propagation in a model human arterial network: Assessment of 1-D visco-elastic simulations against in vitro measurements. Journal of Biomechanics, 44 (2011), 2250-2258. 20 N. Bessonov, A. Sequeira S. Simakov Yu. Vassilevskii V. Volpert Methods of blood flow modelling

[3] J. Alastruey, S.M. Moore, K.H. Parker, T. David, J. Peir´o, S.J. Sherwin. Reduced modelling of blood flow in the cerebral circulation: Coupling 1-D, 0-D and cerebral auto-regulation models. International journal for numerical methods in fluids, 56 (2008), no. 8, 1061-1067.

[4] J. Alastruey, K.H. Parker, J. Peir´o, S.J. Sherwin. Lumped parameter outflow models for 1-D blood flow simulations: effect on pulse waves and parameter estimation. Communications in Computational Physics, 4 (2008), no. 2, 317-336.

[5] A.G. Alenitsyn, A.S. Kondratyev, I. Mikhailova, I. Siddique. Mathematical modeling of thrombus growth in microvessels. Journal of Prime Research in Mathematics, 4 (2008), 195-205.

[6] D. Alizadehrad, Y. Imai, K. Nakaaki, T. Ishikawa, T. Yamaguchi. Parallel simulation of cellular flow in microvessels using a particle method. Journal of Biomechanical Science and Engineering, 7 (2012), no. 1, 57-71.

[7] M.P. Allen, D.J. Tidesley. Computer Simulation of Liquids. Clarendon, Oxford, 1987.

[8] T. AlMomani, H.S. Udaykumar, J.S. Marshall, K.B. Chandran. Micro-scale dynamic simulation of erythrocyte-platelet interaction in blood flow. Annals of Biomedical Engineering, 36 (2008), no. 6, 905-920.

[9] M. Anand and K.R. Rajagopal. A shear-thinning viscoelastic fluid model for describing the flow of blood. Int. J. of Cardiovascular Medicine and Science, 4 (2004), no. 2, 59–68.

[10] M. Anand, K. Rajagopal, K.R. Rajagopal. A model for the formation, growth, and lysis of clots in quiescent plasma. A comparison between the effects of antithrombin III deficiency and protein C deficiency. J. Theor. Biol., 253 (2008), no. 4, 725–738.